

THAT WHICH IS CLAIMED:

1. A method for superplastically forming a blank to produce a first structural member having a predetermined configuration, the method comprising:
providing the blank comprising titanium and having a grain size of less than about 2 micron;
heating the blank to within a superplastic forming temperature range of the blank; and
superplastically forming the blank at a forming temperature of less than about 1500 °F to produce the structural member having the predetermined configuration.
2. A method according to Claim 1 wherein said providing step comprises providing the blank formed of Ti-6Al-4V.
3. A method according to Claim 1 wherein said providing step comprises providing the blank having a grain size of between about 0.8 and 1.2 micron.
4. A method according to Claim 1 wherein said providing step comprises providing the blank having a grain size of about 1 micron.
5. A method according to Claim 1 wherein said superplastically forming step comprises forming less than about 0.001 inch alpha case oxide layer on each surface of the structural member.
6. A method according to Claim 1 further comprising pickling the structural member to remove alpha case oxide formed thereon during said superplastically forming step.
7. A method according to Claim 6 wherein said pickling step comprises subjecting the structural member to a pickling fluid and thereby removing material from surfaces of the structural member at a rate less than about 5×10^{-5} inch per minute.

8. A method according to Claim 6 wherein said pickling step comprises removing less than about 0.001 inch from each surface of the structural member.
9. A method according to Claim 6 wherein said superplastically forming step comprises forming the blank to a thickness less than about 0.002 inch greater than a desired thickness of the structural member.
10. A method according to Claim 1 wherein said superplastically forming step comprises superplastically forming the structural member at a temperature between about 1400 °F and 1450 °F.
11. A method according to Claim 1 wherein said superplastically forming step comprises superplastically forming the blank at a strain rate of at least about 6×10^{-4} per second.
12. A method according to Claim 1 wherein said superplastically forming step comprises superplastically forming the blank at a strain rate of at least about 1×10^{-3} per second.
13. A method according to Claim 1, further comprising providing a second structural member and diffusion bonding the second structural member to at least one of the blank and the first structural member.
14. A method according to Claim 13 wherein said step of providing the second structural member comprises providing the second structural member comprising titanium with a grain size of greater than about 2 microns.
15. A superplastically formed structural member formed according to the steps of Claim 1.
16. A method for superplastically forming a blank to produce a structural member having a predetermined configuration, the method comprising:
 - providing the blank formed of Ti-6Al-4V and having a grain size of between about 0.8 and 1.2 micron;

heating the blank to within a superplastic forming temperature range of the blank;

superplastically forming the blank at a forming temperature of less than about 1450 °F to produce the structural member having the predetermined configuration, thereby forming a layer of alpha case oxide of less than about 0.001 inch thickness on each surface of the structural member; and

pickling the structural member to remove the alpha case oxide layer.

17. A method according to Claim 16 wherein said providing step comprises providing the blank having a grain size of about 1 micron.

18. A method according to Claim 16 wherein said pickling step comprises subjecting the structural member to a pickling fluid and thereby removing material from surfaces of the structural member at a rate less than about 5×10^{-5} inch per minute.

19. A method according to Claim 16 wherein said pickling step comprises removing less than about 0.001 inch from each surface of the structural member.

20. A method according to Claim 16 wherein said superplastically forming step comprises forming the blank to a thickness less than about 0.002 inch greater than a desired thickness of the structural member.

21. A method according to Claim 16 wherein said superplastically forming step comprises superplastically forming the structural member at a temperature of about 1425 °F.

22. A method according to Claim 16 wherein said superplastically forming step comprises superplastically forming the blank at a strain rate of at least about 6×10^{-4} per second.

23. A method according to Claim 16 wherein said superplastically forming step comprises superplastically forming the blank at a strain rate of at least about 1×10^{-3} per second.

24. A method according to Claim 16, further comprising diffusion bonding at least a portion of at least one of the blank and the structural member at a temperature of less than about 1500 °F.

25. A method according to Claim 24 wherein said diffusion bonding step comprises diffusion bonding at least one of the blank and the structural member to a member comprising titanium with a grain size of greater than about 2 microns.

26. A method for diffusion bonding first and second surfaces of at least one structural member, the method comprising:
providing the structural member comprising titanium and having a grain size of less than about 2 micron;
heating the structural member; and
urging the first and second surfaces of the structural member together at a temperature of less than about 1500 °F to diffusion bond the first and second surfaces.

27. A method according to Claim 26 wherein said urging step comprises urging the first and second surfaces of the structural member together with a pressure of at least about 250 psi for at least about 30 minutes.

28. A method according to Claim 26 wherein said providing step comprises providing the structural member formed of Ti-6Al-4V.

29. A method according to Claim 26 wherein said providing step comprises providing the structural member having a grain size of between about 0.8 and 1.2 micron.

30. A method according to Claim 26 wherein said providing step comprises providing the structural member having a grain size of about 1 micron.

31. A method according to Claim 26 further comprising forming less than about 0.001 inch alpha case oxide layer on each surface of the structural member during diffusion bonding.

32. A method according to Claim 26 further comprising pickling the structural member to remove alpha case oxide formed thereon during diffusion bonding, wherein said pickling step comprises subjecting the structural member to a pickling fluid and thereby removing material from surfaces of the structural member at a rate less than about 5×10^{-5} inch per minute.

33. A method according to Claim 32 wherein said pickling step comprises removing less than about 0.001 inch from each surface of the structural member.

34. A method according to Claim 26 wherein said heating step comprises heating the structural member to a temperature less than about 1450 °F.

35. A method according to Claim 26 wherein said providing step comprises providing a first structural member comprising titanium and having a grain size of less than about 2 micron and a second structural member comprising titanium and having a grain size of greater than about 2 microns, the first and second structural members defining the first and second surfaces, respectively.